

# Instructions

for the



## SOUND FLASHER

Model SK-109

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### INTRODUCTION

The Heathkit Model SK-109 Sound Flasher is a sound sensing unit, it picks up room sounds and flashes lights that you connect to it. The lights will flash at varying intensity, depending on the sound level. This Manual includes step-by-step assembly instructions, simple operation directions, a brief troubleshooting guide, and a schematic diagram. For additional information on the product description, product applications, and educational material consisting of circuit theory and a quiz, refer to the SK-100 Series Educational Manual.

Refer to the "Kit Builders Guide" for additional information on:

- Parts identification.
- Tools.
- Wiring.
- Soldering.
- Step-By-Step Assembly procedures.
- Waranty and Customer Service information.

## PARTS LIST

Remove the parts from the shipping carton and check each part against the following list. The key numbers correspond to the numbers on the "Parts Pictorial." Do not remove components that are supplied on a tape from the tape until you use them in a step. Return any part that is in an individual envelope back into the envelope after you have identified it, until that part is called for in a step. Do not throw away any packing material until you account for all the parts.

KEY No.	HEATH Part No.	QTY	DESCRIPTION	CIRCUIT Comp. No.
------------	-------------------	-----	-------------	----------------------

### RESISTOR

A1	6-103-2	2	10 kΩ, 2-watt, 5% (brn-blk-org)	R22, R23
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### CAPACITORS

B1	21-140	2	.001 μF (Z5P) ceramic	C3, C8
B1	21-71	4	.001 μF (Z5U) ceramic	C17, C18, C19, C21
B2	25-900	4	1 μF electrolytic	C4, C9, C12, C13
B2	25-920	3	68 μF electrolytic	C2, C6, C14
B3	27-27	1	.022 μF Mylar	C16

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" in the "Kit Builder's Guide."

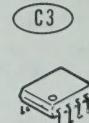


### TRANSISTORS – INTEGRATED CIRCUITS (ICs)

NOTE: Transistors and integrated circuits may be marked for identification in any one of the following four ways:

1. Part number.
2. Type number. (For integrated circuits, this refers only to the numbers and letters shown in **BOLD** print. Disregard any other numbers or letters shown on the IC.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

C1	417-294	1	MPSA42 transistor	Q3
C1	417-801	2	MPSA20 transistor	Q1, Q2
C2	417-953	1	TIP 150 transistor	Q4
C3	442-21	1	MC1458 IC	U1
C3	442-53	1	NE555 IC	U2



**HARDWARE**

D1	250-1469	6	4-40" 5/16" screw
D2	250-1319	4	4-40" 5/8" screw
D3	252-2	6	4-40 nut
D4	254-9	6	#4 lockwasher
D5	255-49	4	Round spacer

(D1)



(D2)



(D3)



(D4)



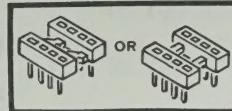
(D5)



(E1)



(E2)



(F1)

**WIRE - SLEEVING**

340-2	6"	Bare wire
344-182	3"	Black wire
344-219	8"	White wire
346-1	4"	Fiber sleeving

**SOCKETS**

E1	434-147	1	AC socket
E2	434-230	2	8-pin IC socket

**LABELS & PRINTED MATERIAL\***

F1	390-2920	1	Identification label
F2		1	Blue and white label
	597-260	1	Parts Order Form
	597-4212	1	Kit Builder's Guide

**MISCELLANEOUS**

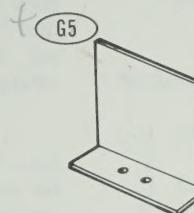
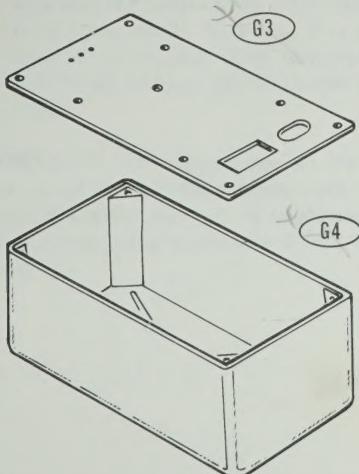
G1	10-325	1	50 kΩ control
G2	75-24	1	Strain relief
	85-3163-1	1	Circuit board
	89-49	1	Line cord
G3	205-1989	1	Case top
G4	408-11	1	Case
G5	215-693	1	Heat sink
G6	263-7	4	Felt pad
G7	480-78	1	Microphone
		1	Manual (see front page for part number)
		1	Solder

R16

(F2)



\* These are packed inside your Manual. Set them aside after you check them.



**TAPED COMPONENTS**

The remaining parts are supplied on taped strips. It is not necessary to check them against the following list.

HEATH Part No.	QTY	DESCRIPTION
-------------------	-----	-------------

**RESISTORS**

All resistors are rated at 1/4 watt, and have a tolerance of 5% (last band gold). The last band (gold) will not be called out.

6-331-12	1	330 $\Omega$ (org-org-brn)
6-561-12	1	560 $\Omega$ (grn-blu-brn)
6-102-12	2	1000 $\Omega$ (brn-blk-red)
6-182-12	1	1800 $\Omega$ (brn-gry-red)
6-222-12	4	2200 $\Omega$ (red-red-red)
6-103-12	3	10 k $\Omega$ (brn-blk-org)

CIRCUIT Comp. No.
----------------------

**RESISTORS (Cont'd.)**

R25
R17
R1, R11
R24
R4, R6, R13, R21
R2, R16, R19

HEATH Part No.	QTY	DESCRIPTION
-------------------	-----	-------------

**Resistors (Cont'd.)**

6-123-12	1	12 k $\Omega$ (brn-red-org)
6-223-12	1	22 k $\Omega$ (red-red-org)
6-104-12	1	100 k $\Omega$ (brn-blk-yel)
6-224-12	4	220 k $\Omega$ (red-red-yel)
6-334-12	1	330 k $\Omega$ (org-org-yel)

CIRCUIT Comp. No.
----------------------

R15
R3
R14
R5, R8, R9, R12
R18

**CAPACITORS**

21-786	5	1 $\mu$ F (104) axial-lead ceramic
		C1, C5, C7, C11, C15

**DIODES**

56-616	1	5.6 V zener
57-27	4	1N5397

D1
D2, D3, D4, D5

**STEP-BY-STEP ASSEMBLY**

Refer to Pictorial 1 as you read the following Notes.

**NOTES:**

1. Many circuit board drawings, such as the one shown in Pictorial 1, are divided into two or more sections. You will be working on each of these sections in a specific series of steps.
2. In each series of steps, you will install parts in a top-to-bottom, left-to-right sequence. Occasionally, you may be directed to install a part out of sequence.
3. Check off each step as you perform it. You may also wish to place a check mark near each component on the Pictorial as you install it.
4. In general, solder instructions are given only at the end of a series of similar steps; you may solder more often if you wish.
5. The circuit board has one side with the component outlines shown on it. This is referred to as the "component side."
- ( ) Position the circuit board as shown in the Pictorial with the component side up. Always install components on the component side of the circuit board and solder the leads to the foil on the other side, unless a step directs you otherwise.
- ( ) Cut the "Taped Components Chart" from the last page in the Illustration Booklet. Make sure you read the instructions at the top of the chart before you use it. Note that it is divided into numbered sections that correspond to the numbered sections on the circuit board pictorials.

**IMPORTANT:** The components on the taped strip are in assembly sequence. Make sure that you do not install a component out-of-sequence; otherwise, the remaining components could also be out-of-sequence.

**Section 1**

- ( ) R2: Cut the first part, a  $10\text{ k}\Omega$  (brn-blk-org) resistor, from the Taped Components Chart. Then refer to the Kit Builder's Guide and follow the procedure outlined on Page 1 to install and solder the resistor at circuit board location R2.

Continue to install the following resistors in the same manner.

- ( ) R1:  $1000\ \Omega$ (brn-blk-red) resistor.
- ( ) R3:  $22\text{ k}\Omega$  (red-red-org) resistor.
- ( ) C1:  $1\ \mu\text{F}$  (104) axial-lead ceramic capacitor.
- ( ) R5:  $220\text{ k}\Omega$  (red-red-yel) resistor.
- ( ) R6:  $2200\ \Omega$ (red-red-red) resistor.
- ( ) R25:  $330\ \Omega$ (org-org-brn) resistor.
- ( ) R4:  $2200\ \Omega$ (red-red-red) resistor.
- ( ) R12:  $220\text{ k}\Omega$  (red-red-yel) resistor.
- ( ) R13:  $2200\ \Omega$ (red-red-red) resistor.
- ( ) R8:  $220\text{ k}\Omega$  (red-red-yel) resistor.
- ( ) C5:  $1\ \mu\text{F}$  (104) axial-lead ceramic capacitor.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

**Section 2**

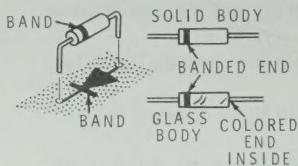
- ( ) R9:  $220\text{ k}\Omega$  (red-red-yel) resistor.
- ( ) C7:  $1\ \mu\text{F}$  (104) axial-lead ceramic capacitor.
- ( ) R11:  $1000\ \Omega$ (brn-blk-red) resistor.
- ( ) C11:  $1\ \mu\text{F}$  (104) axial-lead ceramic capacitor.

- ( ) R14: 100 kΩ (brn-blk-yel) resistor.
- ( ) R16: 10 kΩ (brn-blk-org) resistor.
- ( ) R15: 12 kΩ (brn-red-org) resistor.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

### Section 3

**NOTE:** When you install a diode, always match the band on the diode with the band mark on the circuit board. The circuit will not work properly if a diode is installed backwards.

If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end inside the diode for the banded end. Look for a band painted on the outside of the glass.



- ( ) D1: 5.6 V zener diode (#56-616).
- ( ) R18: 330 kΩ (org-org-yel) resistor.
- ( ) R17: 560 Ω(grn-blu-brn) resistor.
- ( ) R21: 2200 Ω(red-red-red) resistor.
- ( ) R19: 10 kΩ (brn-blk-org) resistor.
- ( ) C15: 1 μF (104) axial-lead ceramic capacitor.
- ( ) R24: 1800 Ω(brn-gry-red) resistor.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

### Section 4

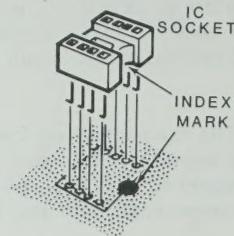
Install four 1N5397 diodes (#57-27) at the following locations:

- ( ) D5.
- ( ) D3.
- ( ) D4.
- ( ) D2.
- ( ) Remove a 1" length of insulation from the black wire.
- ( ) Cut one 1" wire strand from the 1" black wire and bend the ends of the wire to fit the hole spacing at FUSE LINK on the circuit board. **NOTE:** Save the remaining wire for possible future use.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

Refer to Pictorial 2 for the following steps.

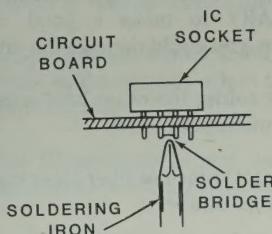
**NOTE:** Before you install an IC socket, make sure the pins are straight. If there is any kind of identification mark (notch, dot, arrowhead, etc.) at or near one end of the socket, place this marked end toward the index mark on the circuit board (this index mark should still be visible after you install the socket). Then start the pins into the circuit board holes.

Hold the socket in place while you turn the board over and lay it on top of the socket on your work surface. The board will hold the socket in place. At first, solder only two pins at diagonally opposite corners of the socket. When the solder cools, check to make sure the socket is tight against the circuit board. If not, reheat the pins while you press against the socket to reseat it. Then solder the remaining pins to the foil.



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NOTE: A solder bridge may occur when you make solder connections at closely spaced foils. Therefore, after each solder step, carefully inspect the foil for solder bridges and remove any that have formed. To remove a solder bridge, hold the circuit board foil-side-down as shown, and hold the soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip to clear the bridge. Refer to the "Circuit Board X-Ray View" if you are unsure of how the foils should look at any location.

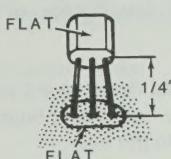


- (✓) 8-pin IC socket at U1.
- (✓) 8-pin IC socket at U2.

Install two 10 kΩ, 2-watt, 5% (brn-blk-org) resistors at the following locations. Space each of these resistors approximately 1/16" off the board.

- (✓) R22.
- (✓) R23.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: Whenever you install a transistor, as in the following step, position it so the flat side is over the flat of the outline on the circuit board, as shown. Then insert the leads into their circuit board holes and position the bottom of the case 1/4" above the board. Bend the transistor leads out slightly on the foil side of the board to hold it in place. Solder the leads to the foil and cut off the excess lead lengths.



- (✓) Q1: MPSA20 transistor (#417-801).
- (✓) Q2: MPSA20 transistor (#417-801).
- (✓) Q3: MPSA42 transistor (#417-294). Bend the center (B) lead back to fit the hole spacing at this location.

Refer to Pictorial 3 for the following steps.

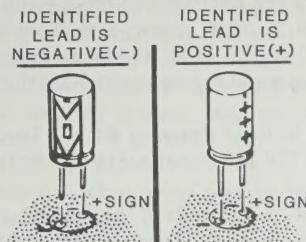
## Section 1

NOTE: When you mount ceramic capacitors in the following steps, do not push the leads all the way through the circuit board holes. The leads have a coating of insulation that may keep you from making a good solder connection.



- (✓) C8: .001 µF (Z5P) ceramic capacitor.
- (✓) C3: .001 µF (Z5P) ceramic capacitor.

When you install an electrolytic capacitor, always identify the markings near the leads. One lead will have a positive (+) mark or a negative (-) mark near it. Be sure to install the positive lead in the positive-marked hole and the negative lead in the negative-marked hole. Note that only the negative lead may have a mark near it.



- (✓) C4: 1 µF electrolytic capacitor.
- (✓) C2: 68 µF electrolytic capacitor.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

- ( v) Refer to inset drawing #3 and carefully bend the microphone wires over so the microphone is approximately 1/16" from the inside of the case top and centered over the three holes as

shown in the Pictorial. Do not stress the wires at the microphone foil connections.

This completes the assembly of your unit. Proceed to "Resistance Tests."

## RESISTANCE TESTS

**WARNING:** Do not apply power to your Sound Flasher for the following resistance tests. You will be instructed when to apply power later.

Refer to Pictorial 6 for the following tests.

You will need a VOM (volt ohmmeter), VTVM (vacuum tube voltmeter), or DMM (digital multi-meter) for the following tests. The ohmmeter for the "Resistance Tests" should have sufficient test voltage to

forward bias semiconductor junctions (at least .7 volts at the probes). The voltmeter for the "Voltage Tests" should have at least a  $10\text{ M}\Omega$  input impedance.

Connect the ohmmeter leads to the following points shown in the chart. If you do not obtain the proper readings, try reversing the meter leads and remeasure the two points. If the readings are still incorrect, refer to "In Case Of Difficulty" on Page 12.

COMMON LEAD	POSITIVE LEAD	RANGE SETTING	READING
Either line cord plug prong.	Other line cord plug prong.	1 KΩ	25 kΩ or more.
TP1	Either line cord plug prong.	1 KΩ	15 kΩ or more.
TP1	Other line cord plug prong	1 KΩ	15 kΩ or more.
TP1	TP2	1 KΩ	1500 Ω or more.
TP1	TP3	1 KΩ	700 Ω or more.
TP1	TP4	100 Ω	500 Ω or more.

- ( ) Disconnect the ohmmeter leads and set it aside.

This completes the "Resistance Tests." Proceed to "Final Assembly."

## FINAL ASSEMBLY

Refer to Pictorial 7 for the following steps.

- (✓) Remove the backing from the blue and white label and press it at the indicated location outside the case.
- (✓) Mount the case top onto the case with four 4-40 × 5/16" screws.
- (✓) Remove the backing from the identification label and press it onto the case top so the top

edge of the label is even with the sensitivity access hole and centered with the outside edges.

- (✓) Remove the backing from the felt pads and press the pads over the round case extrusions near the four corners as shown.

This completes the "Final Assembly."

## SOUND FLASHER CHECKOUT

Refer to Pictorial 8 for the following steps.

**WARNING: The full AC line voltage is present at several locations and is potentially lethal. DO NOT APPLY POWER with the case top removed.**

- (✓) Use a small-bladed screwdriver and set the SENSITIVITY control to its approximate mid-range position, as shown in the inset drawing.
- (✓) Plug a string of miniature christmas lights or a 40-watt light bulb (that you are sure is working properly) into the AC socket.

**NOTE:** If you do not obtain the correct results in the following steps, unplug the unit and proceed to "In Case Of Difficulty."

( ) Plug the Sound Flasher's line cord into an AC wall outlet. The lights should glow steady when there is no noise, and flash when you speak. The louder you speak, the brighter the lights should flash.

- ( ) Adjust the SENSITIVITY control to the desired level.
- ( ) Unplug the Sound Flasher's line cord and then unplug the string of lights.

**IMPORTANT:** DO NOT CONNECT more than three strings of miniature christmas tree lights (rated at 120 VAC, .15-ampere, 18 watts each, 55-watts total) at a time, or you will overload your Sound Flasher.

This completes the checkout.

## IN CASE OF DIFFICULTY

This part of the Manual will help you locate and correct difficulties which might occur in your Sound Flasher. Perform the "Visual Checks" first. You can also refer to the "Troubleshooting Chart," which calls out specific problems that may occur, and lists one or more conditions or components that could cause each difficulty.

Refer to the "Circuit Board X-Ray View" (Page 14) to locate the circuit components, and to compare foil patterns in case you suspect that a solder bridge exists between the foils.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information in the "Kit Builder's Guide." Your Warranty is located there also.

### VISUAL CHECKS

1. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many difficulties by carefully inspecting each connection to make sure it is soldered as described in the Kit Builders Guide. Reheat any doubtful connections.

2. Check the circuit board to be sure there are no solder bridges between adjacent connections.
3. Check capacitor values carefully. Be sure the proper value part is installed at each capacitor location, and that the positive (+) or negative (-) marks on electrolytic capacitors are oriented correctly.
4. Be sure the correct diode is installed at each diode location, and that the banded end is positioned correctly.
5. Recheck the wiring. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
6. Check all component leads connected to the circuit board. Make sure that none of the leads make contact with other connections or components.
7. Check the transistors and integrated circuits for proper type and installation.

**WARNING: The full AC line voltage is present at several points and is potentially lethal. DO NOT work on this unit with the power applied.**

## Troubleshooting Chart

The following Troubleshooting Chart lists specific difficulties that could occur in your Sound Flasher. Several possible causes may be listed for each difficulty. Refer to the Schematic diagram and to the "Circuit Board X-Ray View" to locate and identify the parts listed in this chart.

If a particular part is mentioned (R1 for example) as a possible cause, check that part and other components connected to it to see that they are installed and/or wired correctly. Also check for solder bridges and poor connections in the surrounding area. It is also possible, on rare occasions, for a part to be faulty and require replacement.

PROBLEM	POSSIBLE CAUSE
Lights do not operate.	1. Sound Flasher not plugged in. 2. Light string defective. 3. Check AC socket and circuit board points C, F, E, and D for proper soldering. 4. Fuse link.
Lights are on, but do not flash.	1. Microphone leads at A and B are interchanged. 2. Microphone foils are shorted at wire connections. 3. Sensitivity set too low. 4. Transistor Q4. 5. ICs U1 and U2.

## SPECIFICATIONS

Power Source .....	120 VAC, 50/60 Hz.
Load .....	.15-ampere @ 18-watts for each string of lights; .45-ampere @ 55-watts total for three strings.
Weight .....	5 oz. (142 grams).
Dimensions .....	5-7/8" L × 2-1/4" H × 3-1/8" D (149.2 × 57.1 × 79.3 mm).

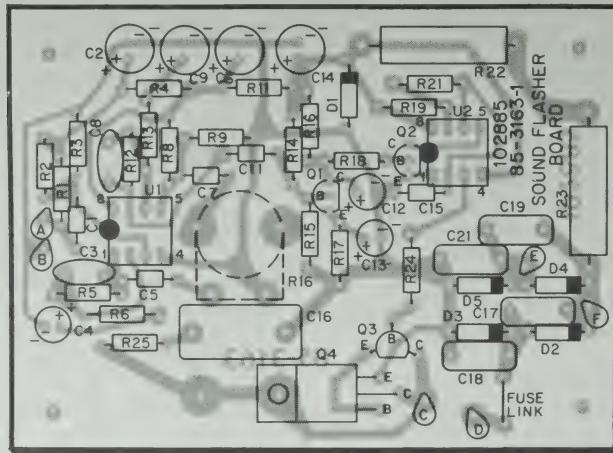
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The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

## CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

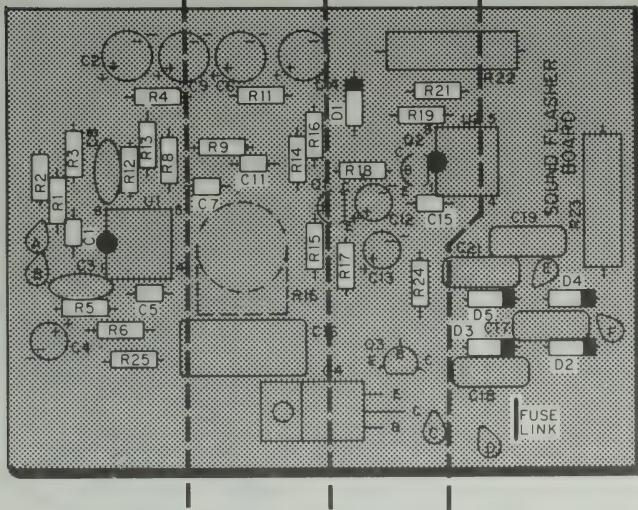
- A. Find the circuit component number (R101, C113, etc.) on the Circuit Board X-Ray View.
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List."
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



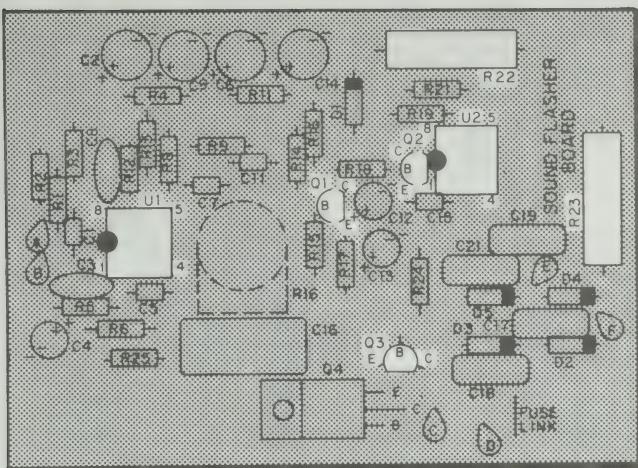
(Shown from the component side.)

# ILLUSTRATION

SECTION 1 | SECTION 2 | SECTION 3 | SECTION 4



PICTORIAL 1

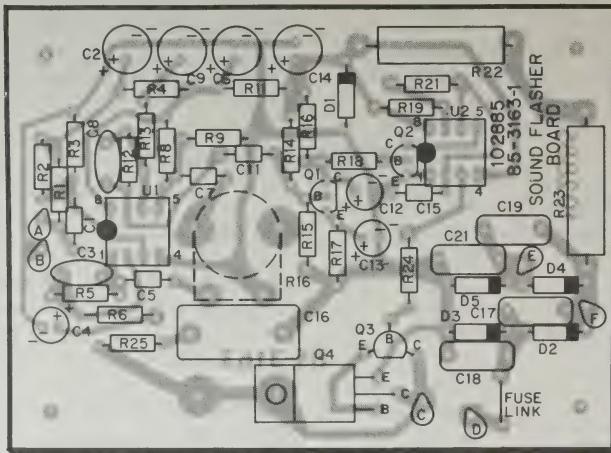


PICTORIAL 2

## CIRCUIT BOARD X-RAY VIEW

**NOTE:** To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R101, C113, etc.) on the Circuit Board X-Ray View.
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List."
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

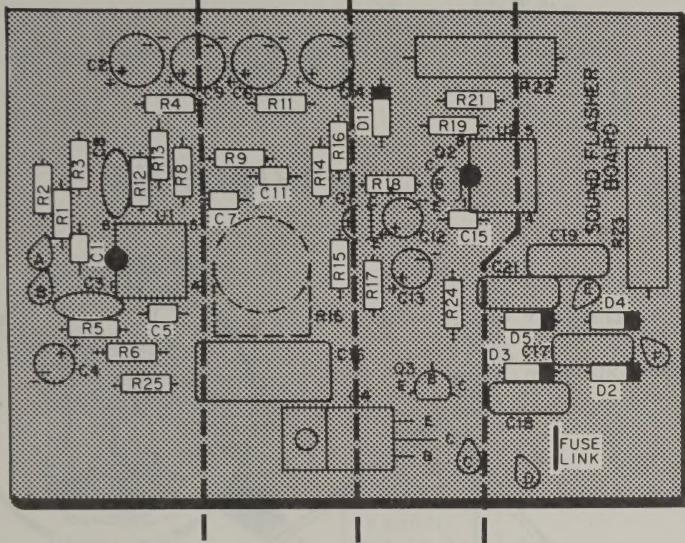


(Shown from the component side.)

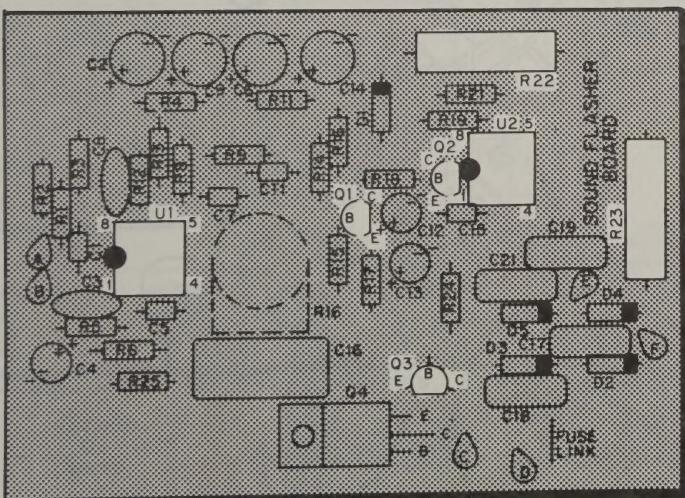
# ILLUSTRATION BOOKLET

Part of 597-4203

SECTION 1 | SECTION 2 | SECTION 3 | SECTION 4

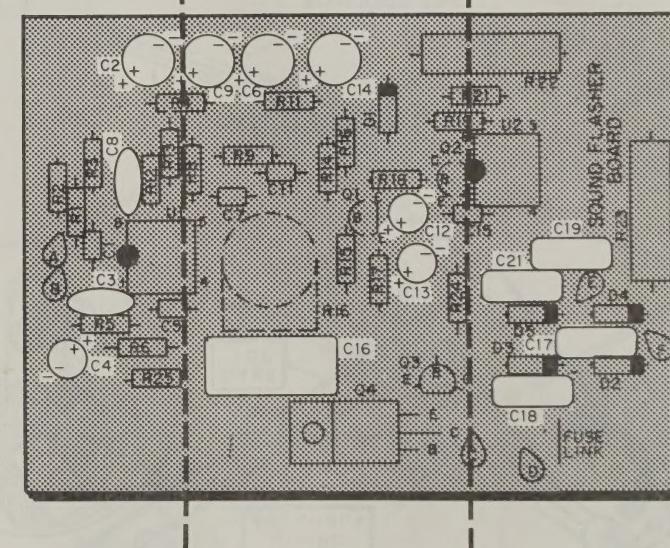


PICTORIAL 1



PICTORIAL 2

SECTION 1 | SECTION 2 | SECTION 3

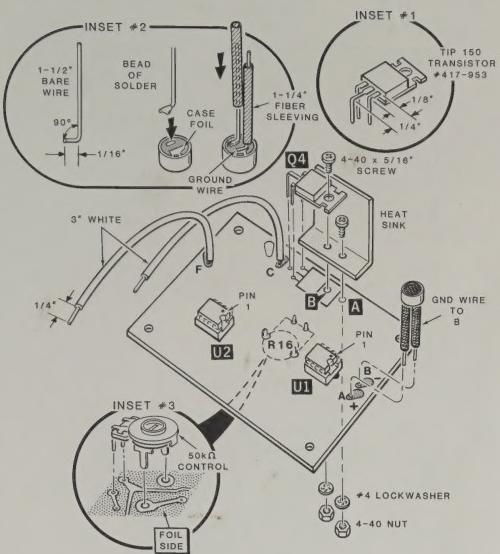


PICTORIAL 3

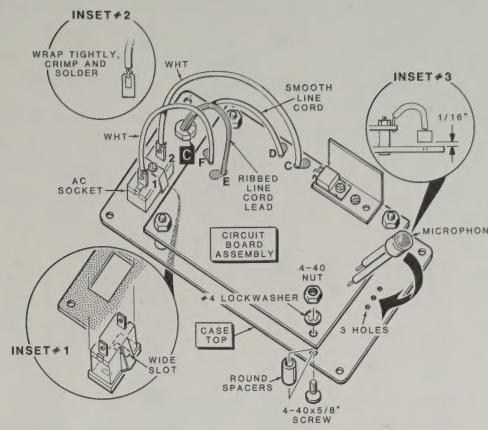
Model SK-109

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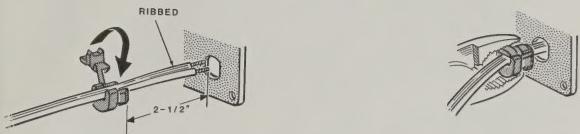
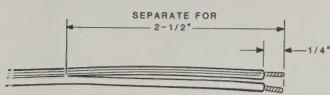
Printed in the United States of America



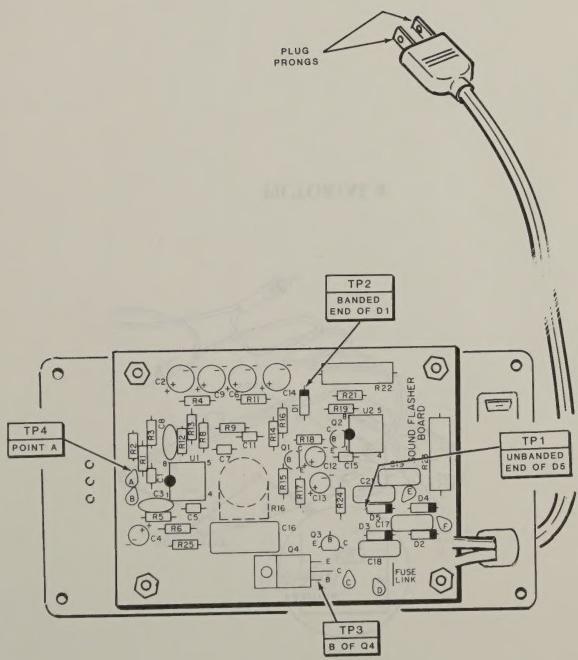
PICTORIAL 4



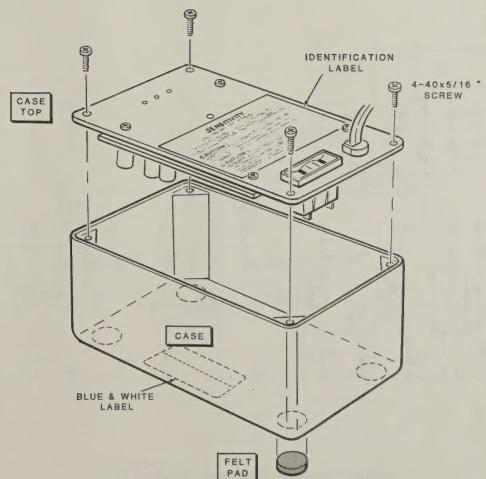
PICTORIAL 5



Detail 5A



PICTORIAL 6



PICTORIAL 7

**SCHEMATIC**

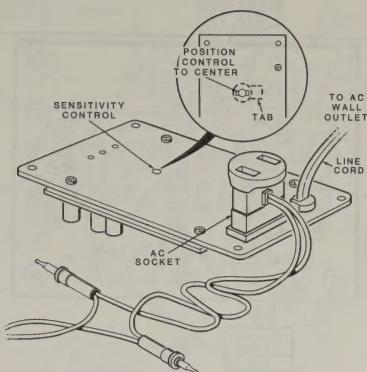
## NOTES:

Resistors are 1/4-watt, 5% tolerance. Resistor values are in ohms; k = 1000.

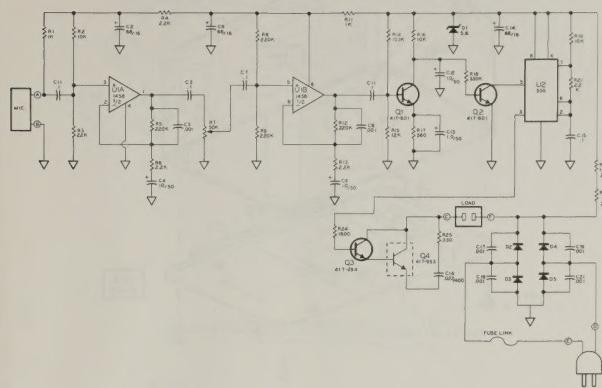
Capacitors are in  $\mu\text{F}$  (Microfarads).

$\nabla$  This symbol indicates circuit board ground.

$\circ$  This symbol indicates a wired connection to the circuit board.



PICTORIAL 8



BOOKLET